Molecular characterization of vasotocin hormone receptors in the sea lamprey to address invasive species ecology and evolution: An Integrated Biosciences approach

Department of Biology Seminar

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LSci 185 at 3:15p.m.

Host: Ben Clarke

Coffee and cookies served in the SSB Atrium at 2:30 p.m.

The sea lamprey (*Petromyzon marinus*) is a jawless (agnathan) vertebrate at an evolutionary nexus between invertebrates and jawed (gnathostome) vertebrates. Lampreys are known to possess the arginine vasotocin (AVT) hormone utilized by all non-mammalian vertebrates. I postulated that the lamprey would possess AVT receptor orthologs of the arginine vasopressin (AVP)/oxytocin (OXT) family of G protein-coupled receptors found in mammals. Sequencing of five putative lamprey AVT receptor genes, molecular phylogeny and synteny (analysis of adjacent genes) support the recently proposed hypothesis that one round (1R) of whole-genome duplication (WGD) took place in the vertebrate lineage prior to divergence of the jawless vertebrates approximately 550 million years ago. The mRNA expression patterns determined in 15 distinct tissues for the AVT hormone and receptor genes show transcription in many lamprey tissues including brain, reproductive tissues, gills, kidneys and immune cells, where function has been demonstrated in jawed vertebrates. The possibility of AVT function in mediating sex pheromone release from glandular cells in the gills of mature male lampreys was tested. The compound petromyzonamine disulfate (PADS) was detected in gill washings from some males at higher quantities after than before injection of AVT or OXT, but no difference was seen for the main sex pheromone component 3-keto petromyzonol sulfate (3kPZS). I also found a pattern of DNA methylation at specific cytosine-guanine (CpG) dinucleotides in the promoter region of one receptor gene, in association with putative transcription factor binding site sequences. The results of my research suggest that, like the multi-functional AVP/OXT receptor family genes in humans and other jawed vertebrates, differential mRNA expression of putative lamprey AVT receptors is generated through epigenetic interaction with regulatory elements in the gene promoter region. Future studies hold promise for human medical as well as invasive species control applications.